Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Petition to Authorize	)	
Co-Primary Sharing of the	)	RM-
450 MHz Air-Ground	)	
Radiotelephone Service	)	
with BETRS	)	

PETITION FOR RULEMAKING

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Summary

The five petitioners here are the same petitioners who asked the Commission to create a Basic Exchange Telecommunications Radio Service (BETRS) in 1986. The Commission eventually agreed with the Petitioners, allocating frequencies in the 150 MHz, 450 MHz and 800 MHz bands on a co-primary basis.

Due to business and spectrum limitations that result from the initial rule, most BETRS applications have occurred within the 450 MHz band, where there are now only 26 shared frequencies. In this area, spectrum-efficient design of BETRS equipment has occurred. While the other bands may eventually become more useful, there are opportunities in the 450 MHz band that can remove the major obstacle to maturity in the BETRS service - the dearth of channels.

Petitioners request that the Commission authorize the use of the older air-to-ground (ATG) service channels and its control channel for BETRS on a co-primary basis. These frequencies are contiguous to the current BETRS frequencies at 450 MHz. Since the Commission has already authorized a full 4 MHz of new spectrum for new ATG service at 800 MHz, and since the change already has been successfully implemented through new licensing, the older ATG channels are no longer attractive for their original purposes, and can be better utilized in the BETRS area. Given the urban focus of the original ATG licenses, and their relative atrophy, a change should not present regulatory or market obstacles and will adversely affect no one. Appendix A contains the necessary technical detail. Prompt action is requested.

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The United States Telephone Association (USTA), National Telephone Cooperative Association (NTCA), Organization for the Protection and Advancement of Small Telephone Companies (OPASTCO), National Rural Telephone Association (NRTA) and the Rural Electrification Administration (REA) (Petitioners) respectfully petition the Commission to commence a rulemaking to authorize Basic Exchange Telecommunications Radio Service (BETRS) to hold co-primary status with the older Air-Ground Radiotelephone Service (ATG) that currently remains operational in the 450 MHz band.[1]

BETRS currently shares, on a co-primary basis, 26 frequencies in the 450 MHz band with the Public Land Mobile Service, but spectrum shortages in many locations have limited the deployment of BETRS systems and have frustrated growth of the service. The older ATG service has 12 frequencies (and a control channel) located contiguous to the existing 450 MHz BETRS frequencies, thus making these channels particularly appropriate for expanded BETRS use. Providing access to these channels by BETRS licensees will strongly promote the public interest in universal, cost-effective telephone

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[1] 47 CFR § 22.600 (1991); 47 CFR § 22.521 (1991).

service. Exchange carriers and their customers can benefit from expansion of channels for BETRS in the 450 MHz band.

In fact, the location of the ATG channels contiguous to the BETRS channels within the 450 MHz band, and the extensive geographic spacing between co-channel ATG licensees, make these frequencies ideal for sharing with the predominately rural BETRS service. Appendix A explains that these two services can coexist without interference as long as a BETRS base station is at least 640 miles from the nearest co-channel ATG base station. Geographic sharing, on a co-primary and non-interference basis, will permit BETRS licensees to expand their existing radio-based services and deliver new services in areas in which spectrum shortages exist. There will continue to be areas that may be denied BETRS availability because of the presence of an ATG base station license. However, as shown below, this potential concern is relatively small, while the net benefit of this Petition is great.

I. BACKGROUND.

A. The Initiation of BETRS. In response to a Petition for Rulemaking by Petitioners filed in the spring of 1986, the Commission authorized the establishment of BETRS in January, 1988.[2] In our original petition for rulemaking, Petitioners proposed two bands of frequencies for providing BETRS. These were the 26 frequencies at 450 MHz that were allocated to the Public

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[2] See Report and Order, CC Dkt. No. 86-495, 3 FCC Rcd 214 (1988) (BETRS Report and Order); Memorandum Opinion and Order on Reconsideration, 4 FCC Rcd 5017 (1989) (Reconsideration Order).

Land Mobile Service in Part 22, Subpart G of the Commission's rules, and 2 MHz of spectrum in the 800 MHz band that was then being held in the "cellular reserve." Co-primary status was requested for the 450 MHz frequencies, and exclusive primary status was requested for the 2 MHz of spectrum in the 800 MHz reserve band.

In the BETRS Report and Order, the Commission authorized co-primary access to both the 150 and 450 MHz bands in the Public Land Mobile Service, and also authorized co-primary access to 50 channels in the 800 MHz Private Radio Service band. However, Petitioners, at the time of the Report and Order and in subsequent reconsideration petitions, explained how the 150 and 800 MHz co-primary allocations would be of secondary benefit for BETRS:

- o There was no advanced digital radio equipment designed specifically to be integrated into the telephone network that was available in these bands to provide the service, as was the case in the 450 MHz band;
- o There was no expression of interest by any manufacturer to provide such equipment in these bands. As a result, the only way to use these bands would be to take commercially available, analog, mobile-radio equipment, and alter it significantly simply to provide the radio-based dial tone connection needed within the telephone network; and
- o The Commission's restrictions on the use of 800 MHz frequencies within 100 miles of the top 50 MSAs and the high occupancy rate at 150 MHz in rural areas made these bands difficult to use, regardless of equipment availability. The

Commission declined to focus its use restrictions better, even on reconsideration.

Experience has borne out the concerns stated by the Petitioners. With rare exception, the frequencies that are used for BETRS today are the 26 shared frequencies in the 450 MHz band. Moreover, increased Public Land Mobile use of those frequencies has restricted BETRS growth and expansion. At the same time, it has been shown that, where it can be made available, BETRS offers real value in the provision of service to rural telephone subscribers.

B. The Air-Ground Radiotelephone Service at 450 MHz. The ATG service was introduced by AT&T in 1957 in Chicago and Detroit under an experimental license, and the Commission authorized the service on a nationwide basis in 1969.[3] During the proceeding leading to the Report and Order establishing the service on a nationwide basis, there was widespread recognition that the 450 MHz band was not well suited to satisfy the aviation industry's needs in the long term. Thus, the Commission said that "[t]he 12 channel system will provide at best only acceptable service,"[4] and it noted that:

> "[t]he wireline carriers recognize, in their support of the proposal, that the operation is merely of an interim nature. . . . In this connection, AT&T points out specifically that several years will be required to perfect a truly sophisticated system, on frequencies not yet allocated, which would offer adequate air-ground service . . . to the whole aviation industry."[5]

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[3] See Report and Order, Dkt. No. 16073, 22 FCC 2d 716 (1969).

[4] Id. at 720.

[5] Id. at 718-719.

In early 1990, the Commission created a entirely new ATG service, engineered to be of higher quality and more spectrum efficient, and designed specifically for use by the aviation industry on a long term basis.[6] The new ATG service, with exclusive operating rights on a full 4 MHz of frequencies in the 800 MHz band, was established to serve both the commercial and private aircraft markets.[7] It has proved to be an attractive service. Two licensees -- GTE Airfone and In-Flight Phone -- already provide nationwide service in this new ATG allocation, and the Commission has licensed four others to provide such service as well.[8]

II. THE CURRENT 450 MHz FREQUENCIES ARE WELL SUITED FOR, BUT INCAPABLE OF SUPPORTING BETRS GROWTH, AND THE CURRENT RULES UNREASONABLY LIMIT THE PUBLIC INTEREST BENEFITS OF BETRS.

In seeking the creation of BETRS, Petitioners pointed out the futility of attempting to use the 150 MHz channels for BETRS under current rules. These channels already were heavily loaded in rural areas, and the inherent propagation characteristics of transmissions on these frequencies presented serious interference problems.[9] Furthermore, Pacific Bell and Nevada Bell (PacTel) and

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[6] See Report and Order, Gen. Dkt. No. 88-96, 5 FCC Rcd 3861 (1990); Memorandum Opinion and Order on Reconsideration, 6 FCC Rcd 4582 (1991).

[7] Id., 5 FCC Rcd at 3880 n. 18.

[8] The FCC announced the grant of licenses on December 24, 1990 to Mobile Telecommunications Technologies, American Skycell, Clairtel Communications, and Jet-Tel.

[9] See Petition for Rulemaking to Establish Basic Exchange Telecommunications Radio Service at 10, n.8, CC Dkt. No. 86-495 (May 9, 1986) (discussing exchange carriers' experience with the 150 MHz band.)

USTA each filed separate petitions for reconsideration of the BETRS Report and Order, pointing out, inter alia, that the restrictions imposed by the Commission's rules on the location of stations that operate on the 800 MHz Private Radio Service channels also rendered these channels unproductive for the provision of BETRS.[10]

The Petitioners' initial concerns have been confirmed in practice. Nearly all of the BETRS systems deployed in the U.S. operate in the 450 MHz band, and all of the advanced, spectrum efficient digital BETRS systems known to the Petitioners to operate on this band. To our knowledge, no similar technology designed specifically to be a part of the exchange carrier infrastructure has yet been deployed on the 150 MHz or 800 MHz channels allocated to BETRS, nor has equipment comparable to that used at 450 MHz yet been built for those channels.[11]

The 450 MHz band now clearly offers some distinct BETRS advantages. Digital BETRS systems operating in the 450 MHz band not only provide privacy but also deliver a degree of spectral

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[10] Section 22.601(a)(2) of the Commission's rules prohibits using these 800 MHz band frequencies for BETRS anywhere within 100 miles of the border of the largest 54 Standard Metropolitan Statistical Areas.

[11] Fewer than one percent of all BETRS installations operate on the 150 MHz or 800 MHz BETRS frequencies. Although a few stations operate in these bands using analog-based IMTS or SMR mobile equipment in a fixed environment, it has limits. For example, analog technology forces the subscriber to forego a degree of privacy on basic telephone service because, as with analog cellular, scanning devices can be used to intercept analog calls. Advanced spectral efficient digital technology, on the other hand, has been developed for use by BETRS in the 450 MHz band.

efficiency not otherwise found in the Public (or Private) Land Mobile Radio Service.[12] There is a developing critical mass of BETRS users at 450 MHz that can help promote the service and generate technology development and deployment economies. In contrast, the 150 MHz and 800 MHz remain less inviting as limited for BETRS. While they may prove to have value, it would require some significant regulatory and manufacturer attention in comparison to 450 MHz.

It is apparent that the practical effect of the Commission's action in establishing BETRS was to have it be effectively available primarily when an exchange carrier could use part or all of the 26 frequencies in the 450 MHz band with Public Land Mobile Radio Service licensees.

III. THE USE OF CELLULAR SPECTRUM DOES NOT PROVIDE AN EFFECTIVE AVENUE FOR THE PROVISION OF BETRS BY EXCHANGE CARRIERS.

The Petitioners have had some indication that Commission staff still may believe that cellular spectrum in rural service areas by itself can be used to satisfy all anticipated demand for BETRS. This perception is longstanding but incorrect.

In the original BETRS proceeding, several participants provided comments to the Commission concerning the opportunity for

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[12] For example, the BETRS system developed by International Mobile Machines is a digital TDMA system which provides four simultaneous conversations on a single 25 KHz channel; additional efficiency is provided through trunking the available channels. Likewise, the BETRS system developed by Rockwell also is a digital TDMA system; it provides two conversations per 25 KHz channel.

provision of BETRS by cellular licensees. They predicted that cellular carriers would not offer BETRS service, and also that exchange carriers would not lease spectrum from cellular carriers for BETRS because it could not be done economically. In contrast, when it denied petitions for reconsideration filed by PacTel and USTA, the Commission anticipated that "cellular spectrum is a source of an abundant number of channels and may be particularly useful in rural areas to construct BETRS systems."[13] At that time, it was unclear what the promise of cellular would be for either rural areas or for fixed service. Time has proved the original commenters to be right.

In fact, over four years of experience has shown that cellular systems simply are not used to provide BETRS. This fact alone should provide ample evidence that, at any time in the foreseeable future, rural cellular is not going to provide the remedy for the spectrum shortage faced by BETRS. The economics of cellular does not promote BETRS. And, in many cases, exchange carriers lack any financial or other interest in the collocated cellular area licensee, and thus cannot use cellular in the provision of BETRS, even if they wanted to.

Cellular systems are not used to provide BETR service because it is uneconomic to do so. Boeing Corporation correctly identified the inherent difference in regulatory incentives for cellular and local exchange carriers, respectively, regarding BETRS:

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[13] Memorandum Opinion and Order on Reconsideration, CC Dkt. No. 86-495, supra, 4 FCC Rcd at 5019.

> "[L]ocal exchange carriers (LECs) typically have an obligation to provide basic 'plain old telephone service' (POTS) throughout their certificated exchange areas. They must therefore extend service to local subscribers even though the marginal costs to the LECs of such service far outstrips the revenue produced by providing that service. To compensate for this forced high cost service, the local exchange carriers are, of course, entitled to include these costs in their regulated rate base, and to recover an averaged rate of return over the base.
>
> * * *
>
> "Since there are no subsidies flowing to a cellular carrier for serving unprofitable areas, there is also no incentive for carriers to serve these areas. In short, the cellular industry is structured to promote competition with traditional profit incentives. The local exchange industry, however, is structured to maximize the availability of basic telephone service. It is in this latter category that [BETRS] -- the service that will constitute the primary telephone service of its subscribers -- more appropriately falls."[14]

The misunderstanding over the potential use of cellular systems to provide BETRS exists in part because of the erroneous assumption that is sometimes made that "fixed cellular" and "BETRS" are synonymous. A cellular carrier can provide fixed service to a subscriber only on a basis that is incidental to its mobile market, but in doing so it can charge whatever rate is appropriate to the situation. In contrast, an exchange carrier typically provides "fixed" telephone service to all, on an averaged-price basis under tariffed rates approved by its state commission. Various state and Federal mechanisms exist to assist rural exchange carriers in keeping the costs of telephone service within reach of all subscribers. As a result, basic telephone service (BETRS or

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[14] See Boeing Electronics Company ex parte presentation, CC Dkt. No. 86-495, (November 12, 1987).

wireline) is normally priced at constrained low levels that an unregulated entrant would not choose to match.

Similarly, expecting an exchange carrier to lease spectrum for BETRS from a cellular carrier is not realistic. This option would dissipate the cost saving that must be anticipated before an exchange carrier will deploy a BETRS system. Further, the uncertainty of operating a basic service on another licensee's spectrum would "chill" the enthusiasm for a radio-based alternative for basic telephone service, and would limit future business judgment in basic networking decisions.

In short, BETRS remains an extension of, and a useful technological alternative to the wire-based infrastructure for exchange carriers. It is not going to reach its potential if it continues to be perceived as a poor cousin of cellular in rural areas that can wait indefinitely for the construction of a cellular tower and switch.[15] The purpose of BETRS is to lower the cost of loops and drive down the overall average cost of basic telephone service. In turn, this can help to hold down local telephone rates, constrain intercompany support flows, and promote universal telephone service at reasonable rates. In an era where incentive regulation is increasingly the norm, BETRS also provides a technological incentive for companies to make their service more

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[15] In commenting on the petition seeking the establishment of the BETRS, the Cellular Telecommunications Industry Association (CTIA) urged the Commission not to "complicate or further delay the implementation of the nationwide cellular network by including cellular frequencies in the BETR rulemaking." CTIA comments, CC Docket 86-495 (March 30, 1987).

efficient, as this helps them to maximize permissible returns.

Finally, not only is it uneconomic to use cellular system channels to provide BETRS, cellular systems often do not even operate in areas where a need for BETRS exists. Economics and good business judgment dictate that cellular licensees will place their base stations where the highest concentration of people or vehicles occurs -- normally in town centers and along highways. That is not the likely location of BETRS subscribers, who reside elsewhere, where any telephone service is not going to be easily cost effective. There, cellular service is likely to remain non-existent and non-cost competitive for the foreseeable future.

IV. WITHOUT ACCESS TO ADDITIONAL USEFUL SPECTRUM, BETRS GROWTH WILL BE CURTAILED AND EXPANSION PLANS WILL BE TERMINATED.

In creating BETRS, the Commission held that BETRS is a service of the highest priority. The Commission made clear that it would allocate additional spectrum if a need for such spectrum were shown. Thus, then-Chairman Patrick called the agency's decision to create BETRS a "major step by the Commission in the pursuit of our goal of extending basic telephone service to as many Americans as possible . . . [,]"[16] and the agency stated that "should these allocations prove to be insufficient at a future date, we will

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[16] Report and Order, CC Dkt. No. 86-495, supra, 3 FCC Rcd at 219 (Statement of Chairman Patrick); see also Memorandum Opinion and Order on Reconsideration, CC Dkt. No. 86-495, supra, 4 FCC Rcd at 5019 ("This Commission is committed to making affordable telephone service available to every citizen who wants it. BETRS is an important means to that end.")

revisit the problem . . . ."[17]

Although the Commission provided adequate spectrum at 450 MHz to get BETRS started, a lack of usable spectrum now frustrates growth of the service. Moreover, the continued questionable reliance on other licensees to either provide the service or to lease spectrum for its provision seriously frustrates the timely deployment and future expansion of BETRS.

In Appendix B, we list specific situations where spectrum shortages have precluded the expansion of BETRS systems. We also address the opportunity that can be made available should the Commission commence and promptly resolve a rulemaking with respect to the older ATG channels.

For example, using the separation criteria in Appendix A, four channels would be immediately available to the Hiawatha Telephone Company in Michigan for needed expansion of its system, and two channels would be available for necessary expansion by the Ponderosa Telephone Company of its BETRS system in California. Appendix B also provides examples of planned systems which were aborted due to the absence of frequencies to accommodate the an exchange carriers immediate needs.

What we have not listed and are unable to list are the hundreds of opportunities to use BETRS systems as a more cost

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[17] Id. 3 FCC Rcd at 216.

effective media for providing telephone service that were not taken even to the planning stage because system expansion was recognized early on to be impossible in the absence of additional spectrum. This last category -- a decision not to install a BETRS system because of inadequate spectrum for future growth -- represents the major obstacle to the rapid deployment of BETRS systems.

V. THE OLDER 450 MHz ATG CHANNELS ARE IDEALLY SUITED FOR SHARED USE BY BETRS.

The 12 channels currently occupied by the older 450 MHz ATG service would be ideal for co-primary sharing with BETRS. The base stations in the ATG service are located near airports around urban areas, while BETRS systems operate in rural areas that are geographically remote from ATG base stations. As described fully in Appendix A, a minimum separation of 640 miles between co-channel ATG and BETRS base stations would guarantee that the two services could co-exist with minimal, if any, interference.

Additionally, there is now little predicted growth in the ATG service in this band. In fact, with the recent allocation of 4 MHz of spectrum for ATG service in the 800 MHz band, it is likely that current use of the 450 MHz ATG spectrum will decline over time. Accordingly, allowing co-primary use of this band also will have the advantage of providing needed spectrum relief for an important basic telephone service while more effectively using spectrum in a band with declining use. A more compatible natural transition mechanism is difficult to envision.

VI. CONCLUSION

The Commission should send a positive message to rural America that it encourages the use of advanced radio technology where it is clearly a good choice for providing basic telephone service in rural areas.

Allowing co-primary status in the older ATG allocation for BETRS will remove the current uncertainty over whether there can be future growth for BETRS systems, and will allow telephone loop planning to proceed with some certainty that sufficient spectrum will be available when needed.

Happily, no one will be adversely affected. The older ATG spectrum in question is underutilized in the rural areas where BETRS systems will operate. Further, in the long run, ATG service will be offered elsewhere, in a large block of spectrum at 800 MHz.

The Commission should act promptly and favorably.

Respectfully submitted,

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APPENDIX A

454 MHz Air-to-Ground/Digital TDMA BETR Service Co-Channel Operation Analysis

This analysis is based on a digital TDMA radio currently type authorized for BETR Service under Commission Section 22.6 Rules.

The analysis shows that under specified worst case conditions, namely aircraft maximum altitude of 50,000 ft. and maximum communications range of 240 miles between aircraft and the air-to-ground radio telephone (RT) base station, the RT and BETR system can operate on a co-channel basis without mutual interference. The required separation distance between RT base station and BETRS base station for these worst case conditions is 640 miles.

Although not included in this analysis, reduced separation distance would be acceptable with a lower maximum aircraft altitude. For example, if the maximum aircraft altitude were 32,000 ft., the RT-to-BETRS base station separation required is 590 miles. If the maximum communications range of the RT system is 200 miles and the maximum aircraft altitude is 32,000 ft., then the spacing would be reduced to 550 miles.

I. SYSTEM PARAMETERS AND ASSUMPTIONS

A. RT System

1. Frequencies

Twelve paired channels spaced 25 KHz plus common signalling channel:

Base Station	454.675 MHz	Signalling
	454.700---.975 MHz	Voice
Aircraft	459.675 MHz	Signalling
	459.700---.975 MHZ	Voice

2. Equivalent Radiated Power (ERP)

Base Station	100 Watts (+50 dBm)
Aircraft	25 Watts (+44 dBm)

3. Frequency Re-Use

Minimum spacing between co-channel base stations: 500 Miles

4. Coverage Radius: 240 Miles

5. Base Station Antenna Height: 200 Ft.

6. Airplane Altitude: 50,000 Ft.

7. Carrier-to-Interference Ratio Required: 6 dB

B. BETRS System

1. Frequencies

Base Station	454.675---.975 MHz
Subscriber	459.675---.975 MHz

2. Equivalent Radiated Power (ERP)

Base Station	12 Watts (+41 dBm) Average
Subscriber	6 Watts (+38 dBm) Average

3. Base Station Antenna Height: 200 Ft.

4. Subscriber Antenna Height: 30 Ft.

5. Coverage Radius: 37.5 Miles

6. Carrier-to-Interference Ratio Required: 26 dB

II. INTERFERENCE ANALYSIS

The analysis is based on the simple coordination rule that the spacing between co-channel RT base station and BETRS base station must be at least 640 miles.

All interference possibilities are studied as follows:

A. Airplane interferes with BETRS base station
B. BETRS base station interferes with airplane
C BETRS subscriber interferes with RT base station
D. RT base station interferes with BETRS subscriber

The calculations for the interference in each possible situation are based on specified worst case conditions. Allowance is made for desired signal power reduction due to fades and for interfering signal power enhancement.

Worst Situation

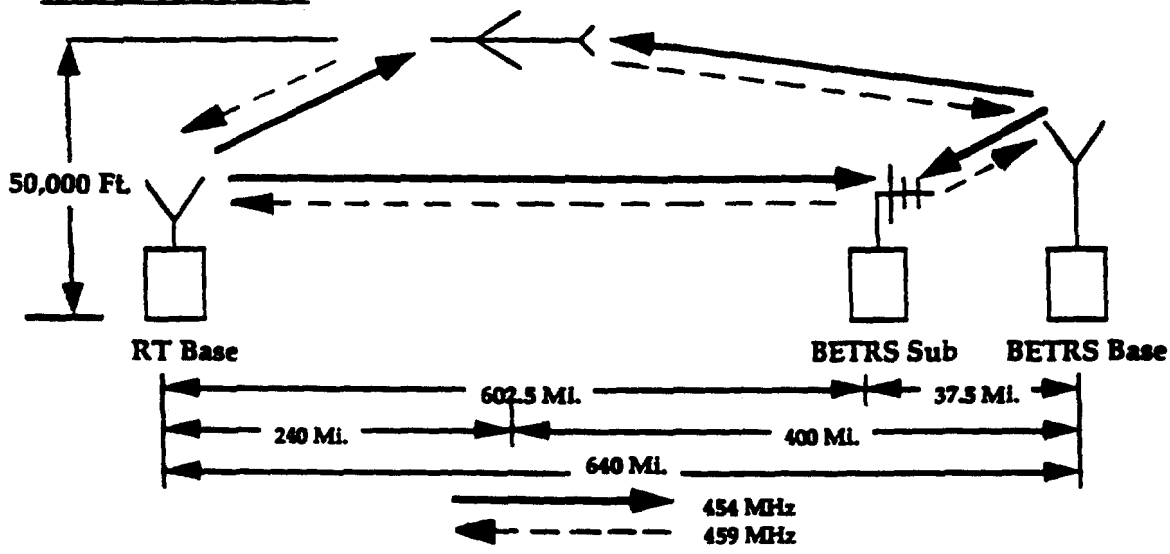

Figure #1: The Worst Interference Situation

The worst configuration is when the airplane is nearest to the BETRS base (400 miles) and at the limit of its range from the RT base (240 miles). Also, the BETRS sub is at the limit of its

range from the BETRS base (37.5 miles) and closest to the RT base (602.5 miles).

The following analyses are based on the worst situation shown in Figure #1.

A. Airplane to BETRS Base Station Interference

Since the BETRS subscriber is proposed to transmit on the same frequency as the airplane, interference may occur at the BETRS base station as shown in Figure #2.

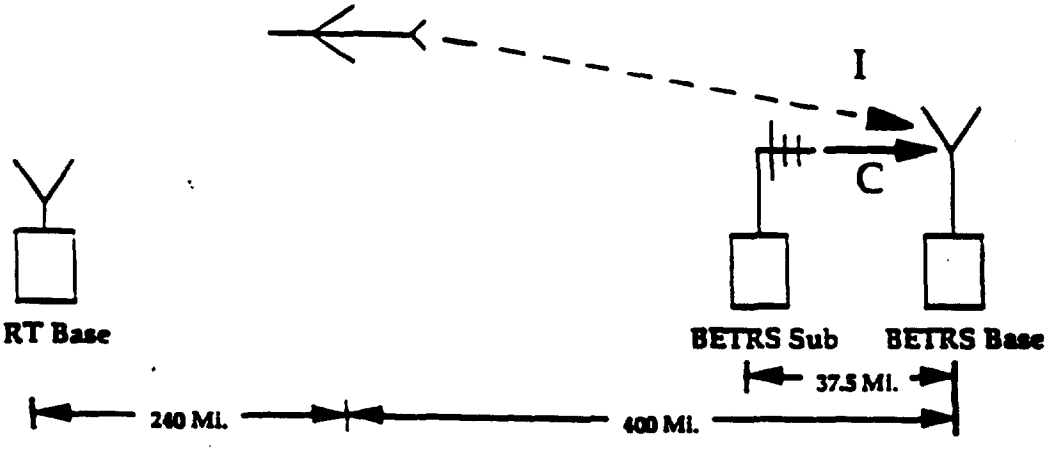

Figure #2: Airplane Interference to BETRS Base

C = Desired carrier power received at BETRS Base from Sub
I = Undesired carrier power received at BETRS Base from Airplane
ERP_C = ERP of BETRS Sub = +38 dBm
ERP_I = ERP of Airplane = +44 dBm
d_C = Distance BETRS Sub to Base = 37.5 Miles
d_I = Distance Airplane to BETRS Base = 400 Miles

$C/I = ERP_C - ERP_I + 20 \text{ LOG } (d_I + d_C) + LOH - FM$

LOH = Over the Horizon Loss for Interference

The radio horizon for the airplane is approximately:

$d_A = \sqrt{2 H_A}$

Where H_A = Airplane Antenna Height = 50,000 Ft.

d_A = 316 Miles

The radio horizon for the BETRS base is:

$d_B = \sqrt{2 H_B}$

Where H_B = BETRS Base Station Height = 200 Ft.

d_B = 20 Miles

The combined radio horizon is:

$d_A + d_B$ = 336 Miles

The interference path length from airplane to BETRS base station is 400 miles. This is clearly a beyond the horizon path of at least 60 miles.

The over the horizon loss LOH is estimated to be

LOH = 40 dB (annual median) (Reference #1)

FM is the allowance for fading of desired carrier, fading of interference signal, and variation of median path loss for specific paths for the desired and interfering signals.

The assumed values are:

F_C = Fading Desired Carrier = 10 dB
F_{CP} = Path Variation Desired Carrier = 10 dB
F_{IP} = Path Variation Interference = 15 dB (Reference #1)
F_I = Fading Interference Signal = 20 dB (Reference #1)

Following the treatment of co-channel interference in Reference #2:

$$FM = K\sqrt{F_C^2 + F_{CP}^2 + F_{IP}^2 + F_I^2}$$

Where K = 1 for 90 percent reliability hence:

$$FM = \sqrt{10^2 + 10^2 + 15^2 + 20^2}$$

$$= 29 \text{ dB}$$

Thus:

$$C/I = 38 - 44 + 20 \text{ LOG } (400 + 37.5) + 40 - 29$$

$$= 26 \text{ dB}$$

The required C/I for BETRS with 16 DPSK modulation is 26 dB.

The requirement is met and no interference impairment is expected from this source.

B. BETRS Base Station-to-Airplane Interference

Since the BETRS base station is proposed to transmit on the same frequency as the RT base station, interference may occur at the airplane as shown in Figure #3.

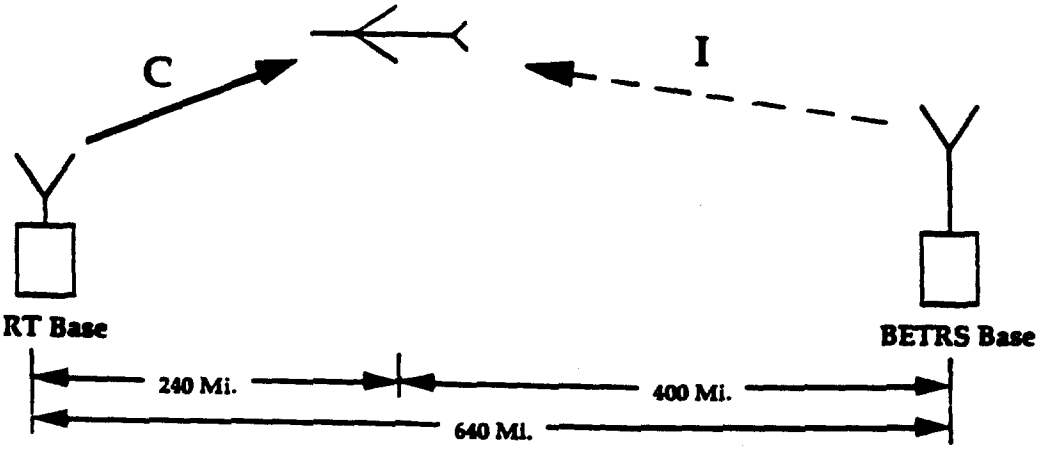

Figure #3: BETRS Base Interference into Airplane

C= Desired carrier power received at Airplane from RT Base

I = Undesired carrier power received at Airplane from BETRS Base

ERP_C = ERP at RT Base = +50 dBm

ERP_I = ERP of BETRS Base = +41 dBm

d_C = Distance Airplane to RT Base = 240 Miles

d_I = Distance Airplane to BETRS Base = 400 Miles

$C/I = ERP_C - ERP_I + 20 \text{ LOG } (d_I + d_C) + LOH - FM$

From Section A above, the interference path from BETRS Base to Airplane is a beyond the horizon path of at least 60 Miles.

LOH = 40 dB

As in Section A above, the FM is the allowance for fading of desired carrier, fading of interference, variation of path loss for specific paths for both desired carrier and interference.

FM = 29 dB

C/I = 50 - 41 + 20 LOG (400 + 240) + 40 - 29

= 24 dB

Since this clearly meets the 6 dB required, no interference is expected from this source.

C BETRS Subscriber-to-RT Base Station Interference

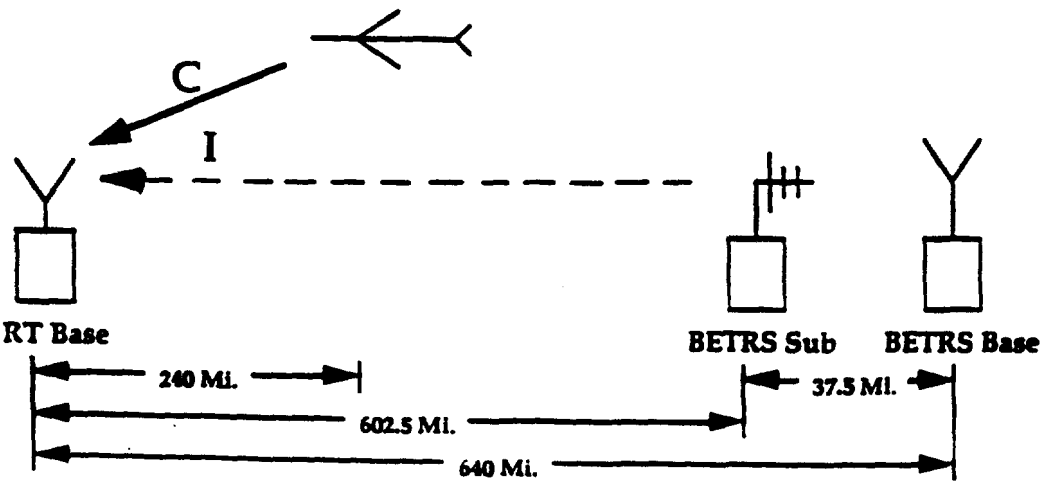

Figure #4: BETRS Subscriber Interference into RT Base